

FAMILY PLACEMENT OF SPECIES PREVIOUSLY INCLUDED IN THE
SCALE INSECT GENUS *SPHAEROCOCCUS* MASKELL
(HEMIPTERA: COCCOIDEA)

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Abstract.—The genus *Sphaerococcus* Maskell has been the “dumping ground” for many rotund scale insects that did not seem to fit elsewhere. Although the genus is a member of the Pseudococcidae as defined by its type species, the family placement of many species is questionable or unknown. The purpose of this paper is to provide evidence for the correct family placement of each species described in *Sphaerococcus*. Twelve taxa are assigned to families in which they have never been placed previously and there are five new combinations and one new synonymy.

Key Words: scale insects, Coccoidea, Pseudococcidae, Lecanodiaspididae, Asterolecaniidae, Eriococcidae, Aclerdidae, Beesoniidae, Kermesidae, Phoenicococcidae

The genus *Sphaerococcus* Maskell is part of the family Pseudococcidae and should contain only two species, i.e. *S. casuarinae* Maskell (the type species) and *S. durus* De Lotto (Ben-Dov 1994). Since the genus was described by Maskell (1892) it has been the “dumping ground” for large rotund scale insects that did not seem to fit any place else.

There are 38 species or varieties that were originally described in the genus; the correct family placement of many of these, until now, has been unknown (Beardsley 1984). Species previously described in *Sphaerococcus* are currently considered to belong to eight different families and often are omitted from catalogs because their family placement is questionable or un-

known. The purpose of this paper is to provide information on the family placement of all species originally described in *Sphaerococcus*. We have summarized the current placement of all 38 taxa, but have not reexamined type material of species that seem to be properly placed. This research is being undertaken so that *Sphaerococcus* species can be properly cataloged in the current initiative called “ScaleNet” (by Ben-Dov and Miller) to database the scale insects of the world (for more information see Miller and Gimpel (1996), Ben-Dov et al. (1997) or check the web site <http://www.sel.barc.usda.gov/scalenet.htm>). Much more research is needed to redescribe all *Sphaerococcus* taxa, to place them in appropriate genera, to designate lectotypes,

and to perform other important taxonomic procedures, all of which is beyond the scope of this publication.

Depository abbreviations are as follows: Australian National Insect Collection, CSIRO, Canberra (ANIC); Agricultural Scientific Collections Trust at New South Wales Agriculture, Orange, Australia (ASCT)(formerly Biological and Chemical Research Institute, Rydalmere, Australia: BCR1); California Academy of Sciences, San Francisco (CASC); The Natural History Museum, London (BMNH); South Australian Museum, Adelaide, Australia (SAM); New Zealand Arthropod Collection, Auckland (NZAC); National Museum of Natural History, Beltsville, MD (USNM); University of California, Davis (UCD); University of Tennessee, Entomology Collection, Knoxville (UT); Virginia Polytechnic Institute and State University, Entomology Collection, Blacksburg (VPI).

Type data are provided for species when this information has not been provided in detail previously. Slide-label data are not provided for syntypes of Maskell's species because his labels included only the name of the species, the sex and instar, the year, and his initials. For example, one of the slides prepared and labeled by Maskell has the following information on the left label: "Sphaerococcus/ leptospermi/ late larva/ 1893 W.M.M."; there is no right label and no further attached information. Material borrowed from NZAC is part of the series mounted by Maskell and is identified by an orange and white sealant that surrounds the cover slip.

HISTORICAL BACKGROUND

Between 1906 and 1909 the entire Maskell Collection was borrowed from the New Zealand Department of Agriculture by the United States Department of Agriculture so that the species and genera described by Maskell could be redescribed and properly placed in the scale insect classification system (Morrison and Morrison 1922). Specimens were photographed, dry material was

mounted, original unstained slide-mounted specimens were examined, and many species were redescribed (Morrison and Morrison 1922, 1923, 1927). A book of photographs is present in the Coccoidea library at Beltsville. This is the U.S. Department of Agriculture's scale-insect reference library which is associated with the USNM collection. Morrison made notes on the material and these notes are included in each of the following species treatments when available. Many of the specimens currently deposited in the USNM were acquired during this process. Morrison was very careful to compare the specimens prepared from dry material with the original slides made by Maskell to be certain that they were specimens of the same taxon. Each slide is enclosed in a paper jacket and is identified by a Maskell collection number. These numbers correspond to a ledger that was kept by Maskell. Unfortunately, he did not include ledger numbers on his slides although they were associated with the dry material. The Maskell Collection was returned to New Zealand in 1922. A few Maskell types were acquired by the USNM as parts of the collections of Brain and Cockerell. Specimens in the BMNH were apparently sent to Green by Maskell. Because of the incompleteness of label data maintained by Maskell, it is not always possible to recognize the type series and it is necessary to presume that "his specimens are original material unless the data labels indicate otherwise" (Deitz and Tocker 1980). Another complicating factor in identifying type material is that Maskell occasionally added additional collections of a species to the same lot of dry material as the type series (Deitz and Tocker 1980).

Scale insect specimens (including syntypes) from the collection of W. W. Froggatt are housed primarily in ANIC and ASCT in Australia, but some additional material was donated to or exchanged with collections outside of Australia and resides in BMNH and USNM. Froggatt's accession notebooks (see Gullan 1984) contain a

number of lists of scale insect specimens sent to other workers. A substantial part of Froggatt's coccoid collection was purchased by the Commonwealth Scientific & Industrial Research Organisation (CSIRO, then called CSIR) in two parts: the first in 1928 and then additional specimens in 1937 after Froggatt's death (Upton, in press). Much of the original material upon which Froggatt based his descriptive catalog (Froggatt 1921) remained in the collection at the Entomological Branch of the New South Wales (NSW) Department of Agriculture in Sydney, which subsequently became the Biological & Chemical Research Institute (BCRI) of NSW Agriculture but recently was relocated to Orange, Australia. Thus, Froggatt's syntypes are distributed among several institutions, although all of his slide mounts (which are in poor condition and mostly require remounting) are housed in ANIC. Froggatt recorded details of his coccoid accessions in two notebooks (Gullan 1984), which are housed in ASCT.

The whereabouts of much of C. Fuller's coccoid collection is unknown, although some syntypic material resides in USNM and SAM, probably as the result of exchange with or donation to these collections.

SPECIES

Sphaerococcus acaciae Maskell, 1893:237

Current placement.—Asterolecaniidae—*Callococcus acaciae* (Maskell) (combination by Morrison and Morrison 1927).

Selected references.—Froggatt (1921:7)(redescription); Morrison and Morrison (1927:11)(redescription, Asterolecaniinae), Koteja (1974:83)(as *Callococcus* group), and Deitz and Tocker (1980:25)(information about types, depositories, and taxonomic history).

Type material.—Syntypes in BMNH include 1 adult female on a slide; NZAC 5 slides and 2 pill boxes of dry material (DRM examined 3 of Maskell's original slides as follows: 1 adult female and several

embryos; 1 first-instar nymph; and 3 first-instar nymphs—they are conspecific with the USNM material); USNM has 4 syntype slides as follows: 2 first-instar nymphs; 12 first-instar nymphs; 1 second-instar male, 1 first-instar nymph; 2 first-instar nymphs; (Maskell Collection No. 282). The Maskell ledger entry is "282. *Sphaerococcus acaciae* Maskell Australia/insects in situ/N. Z. Trans. Vol. XXV, p. 237." There are no notes by Morrison, but there is a photograph with the label "Sphaerococcus acaciae Mask./Adult and Immature Females/Maskell Coll. No. 282" in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland.

Type data.—Australia, New South Wales, Queanbeyan, on *Acacia* sp., A. S. Olliff.

Discussion.—Based on examination of syntype material, DRM concurs with the placement of this taxon in the Asterolecaniidae (Morrison and Morrison 1927) primarily because the first-instar nymph has 8-shaped tubular ducts and the adult female has 8-shaped pores and tubular ducts with characteristic asterolecaniid internal longitudinal lines. The first-instar nymphs are dimorphic as in *Callococcus leptospermi* Maskell (Coles et al. 1988) and *C. pulchellus* (Maskell), but the adult female of *C. acaciae* is quite different and may not be congeneric.

Sphaerococcus africanus Brain, 1915:95

Current placement.—Pseudococcidae—*Lenania africanus* (Brain) (combination by Ben-Dov et al. 1997).

Selected references.—De Lotto (1969:23)(redescription, likely referred to *Lenania*), Ben-Dov et al. (1997:203)(as *Lenania africanus*).

Type material.—Syntypes in USNM include: 1 slide containing 3 adult females with the left label "1850/on field bush/Somerset West/T. F. D./26.11.06/africanus Brain/Sphaerococcus;" right label "13/32./C. K. B."; 3 other slides containing 51 first-instar nymphs, 4 adult females, and 1

adult female: all slides are labeled similarly, with left label "*Sphaerococcus/africanus* Brain/on *Cliffortia ruscifolia* L./Stellenbosch, CP/17.XII.'14./paratype.:" right label "B. 32./C. K. B."

Type data.—In addition there is another lot of material from South Africa, Stellenbosch, On *Elytropappus rhinocerotis* Less., November 10, 1914, C. P. van der Merwe. We do not know where this material is located.

Discussion.—This species was described in detail by De Lotto (1969) and was cataloged by Ben-Dov (1994); for additional information refer to these publications.

Sphaerococcus bambusae Maskell,
1893:237–238

Current placement.—Pseudococcidae—*Chaetococcus bambusae* (Maskell); type species of *Chaetococcus* (combination by Maskell 1898).

Selected references and discussion.—This species was described in detail by Williams (1985) and was cataloged by Ben-Dov (1994); for additional information refer to these publications.

Sphaerococcus cantentulatus Froggatt,
1921:8

Current placement.—Lecanodiaspididae—*Celaticoccus cantentulatus* (Froggatt) (combination by Lambdin and Kosztarab 1976).

Selected references.—Lambdin and Kosztarab (1976:56)(Description of genus and redescription of species; placed in Lecanodiaspididae).

Type material.—The lectotype and several paralectotypes were designated by Lambdin and Kosztarab (1976) and are in BMNH, and paralectotypes also were deposited in USNM and two other American institutions. These specimens are from the type locality of Condobolin (as evidenced by label data), and were sent by W. W. Froggatt to R. Newstead in England in February 1903 as recorded on page 110 of Froggatt's first accession notebook by the

entry: "40 *Sphaerococcus cantentulatus* n. sp. Green, M.S. Condobolin." According to DJW it appears that this material was sent directly to Green by Newstead since the slides are labeled in Green's handwriting. Thus, this material was sent to Newstead [and Green] 18 years prior to Froggatt's description of the species. In addition to the above specimens there are paralectotypes in ASCT and ANIC that were not borrowed, examined or listed by Lambdin and Kosztarab (1976). ASCT holds 2 slide-mounted adult females (mounted by P. J. Gullan, 1997, ex dry material) and 2 dry-mounts each bearing a number of galls, with the label data: "(Acac. pendula)/Bramble Station near/Condobolin N.S.W./17.10.00" and "342." One of these mounts is that photographed for figure 3 of the original description in Froggatt (1921). ANIC holds 3 dry-mounts which PJG also has identified as paralectotypes; all are labeled in Froggatt's handwriting as *Sphaerococcus cantentulatus*. One mount has the data label: "(Acac. pendula)/Bramble Station near/Condobolin, N.S.W./17–10–00," another has: "N.S.Wales/Condobolin/W.W.F./Acacia stem/galls/15/x/1902" and the third mount has no data label.

Discussion.—PJG has mounted and examined females from Froggatt's original collection and notes that the illustration of the adult female in the Lambdin and Kosztarab (1976) paper is inaccurate in the position of the spiracles. They drew the spiracles as ventral, but they lie on the margin of the dorsal area that bears the 8-shaped pores. This position is best seen on a specimen that has the dorsum and venter separated. The collection date listed by Lambdin and Kosztarab is October 19, 1900; the correct date is October 17, 1900.

Sphaerococcus casuarinae Maskell,
1892:39–41

Current placement.—Pseudococcidae—*Sphaerococcus casuarinae* Maskell (1892); type species of *Sphaerococcus*.

Selected references and discussion.—

This species was described in detail by Williams (1985) and was cataloged by Ben-Dov (1994); for additional information refer to these publications.

Sphaerococcus cupressi Ehrhorn,
1911:277

Current placement.—Pseudococcidae—*Ehrhornia cupressi* (Ehrhorn); type species of *Ehrhornia* (current combination by Ferris 1918).

Selected references and discussion.—This species was described in detail by Ferris (1918, 1953) and was cataloged by Ben-Dov (1994); for additional information refer to these publications.

Sphaerococcus diaspidiformis Green,
1916:64

Current placement.—Asterolecaniidae—*Mycococcus diaspidiformis* (Green) (current combination by Ferris 1952).

Selected references.—Ferris (1952)(as Asterolecaniidae in *Mycococcus* based on Green's 1916 description)

Type material.—Syntypes in BMNH include 4 slides labeled as type or cotype with the following specimen label data: "Sphaerococcus/diaspidiformis/Green/on leaf stalk of Palm/Stapleton, N.T./Australia/G.F.H. 640.J.B.E.93." These slides include the following: 12 adult females; 11 adult females; 2 adult females; 10 adult females. There also are 2 lots of dry type material in the BMNH; the most complete label is as follows: "Sphaerococ. diaspidiformis/(type material)/Livistonia humilis/on leaf stalk of Palm sp./Stapleton, N.T. Australia/coll. G. F. Hill, No. 640/JBE 93." A single syntype slide in USNM contains a complete adult female and parts of others, also several embryos; it is labeled as follows: "Sphaerococcus/diaspidiformis Green/On leaf stalk of Palm sp./Stapleton, N.T. Australia/G. F. Hill, Coll. (E. E. Green)/Let. June 5, 1916 #14681/From Part of Type Material." There also is a box of dry material that contains 30 or 40 specimens

on the host and has the same associated data as that mentioned above.

Discussion.—This species is clearly not congeneric with *Mycococcus copernicae* Ferris, which is the type of the genus, since it (*M. diaspidiformis*) does not have 8-shaped pores in the first-instar nymph. Family placement of this species is enigmatic but we tentatively agree with Ferris' (1952) asterolecaniid assignment because it has: Small ducts on the head that appear to be homologous with the "dorsal tubes" mentioned by Russell (1941), a heart-shaped labium that is indistinctly 2-segmented which is present in some asterolecaniids (Koteja 1974), simple quinquelocular pores, anal ring with an anal tube similar to *Polea* (see Lambdin 1977), and an unsegmented antenna.

Sphaerococcus draperi Newstead 1906:70

Current placement.—Phoenicococcidae—it is considered to be a junior synonym of *Phoenicococcus marlatti* Cockerell (see Newstead (1911) and Borchsenius (1966)).

Type material.—Syntypes in BMNH labeled as follows: "Phoenicococcus/marlatti, Ckll/=-Sphaerococcus/draperi, New./Newsteads'/Co-types./Egypt/B.M. 1945, 131." In addition there is a lot of dry material that is part of the type series labeled as follows: "Sphaerococcus. n.sp. (Newstead)/on Palm Leaf/Egypt. 4.iii.1906/W. Draper."

Discussion.—DJW has studied the syntypes of this species and concurs that it is identical with *P. marlatti*.

Sphaerococcus durus De Lotto, 1969:23

Current placement.—Pseudococcidae—*Sphaerococcus durus* De Lotto.

Selected references and discussion.—This species was described in detail by De Lotto (1969) and cataloged by Ben-Dov (1994); for additional information refer to these publications.

Sphaerococcus elevans Maskell, 1895:68

Current placement.—Eriococcidae—*Floracoccus elevans* (Maskell); type spe-

cies of *Floracoccus* (combination by Beardsley 1974).

Selected references and discussion.—This species was described in detail by Beardsley (1974); for additional information refer to this publication. There is a photograph with the label “*Sphaerococcus elevans* Mask./Female ‘Galls’ on Bark/Maskell Coll. No.435” in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland.

Sphaerococcus ethelae Fuller, 1899:449

Current placement.—Pseudococcidae—*Peridiococcus ethelae* (Fuller) (combination by Williams 1985).

Selected references and discussion.—This species was described in detail by Williams (1985) and was cataloged by Bendov (1994); for additional information refer to these publications.

Sphaerococcus ferrugineus Froggatt,
1898:378

Current placement.—Beesoniidae (?)—“*Sphaerococcus*” *ferrugineus* Froggatt, **new family assignment.**

Selected references.—Froggatt (1921: 10)(description of gall and external appearance of female).

Type material.—There are 2 dry-mounts (total of 3 galls on 2 stem pieces) in Froggatt’s collection in ANIC and both are labeled in his handwriting. PJG considers them to be syntypes. One mount with 2 galls (one mature, other small) is labeled: “*Sphaerococcus/ferrugineus/Frg/New South Wales*” and the other with a single mature gall is labeled: “*Sphaerococcus/ferrugineus/Fro/N. S. Wales.*” Neither of these mounts is that photographed for figure 4 of Froggatt (1921) and thus there may be further unlocated syntypes.

Discussion.—PJG has examined specimens of this species and indicates that the correct family placement of this species is questionable based on the information available. The species has very distinctive galls that resemble those formed by the

Beesoniidae. Mature females (non-type) have shallowly invaginated quinquelocular pores (like Beesoniidae and some Eriococcidae) and large bases to the clypeolabral shield (like Beesoniidae). Young adult females and first-instar nymphs are needed before the family placement can be confirmed.

Sphaerococcus froggatti Maskell,
1894:94

Current placement.—Eriococcidae—“*Sphaerococcus*” *froggatti* Maskell, **new family assignment.**

Selected references.—Cockerell (1896: 329)(checklist, included in Idiococcinae), Froggatt (1907:380) and Froggatt (1921: 10)(redescription of adult female and gall in Idiococcinae), Deitz and Tocker (1980: 20)(family status uncertain, literature citations, and list of types), Beardsley (1984: 88)(mentioned as unplaced in a family).

Type material.—Syntypes in the NZAC include 2 slides and 2 pill boxes of dry material (DRM examined both of Maskell’s original slides as follows: 1 adult female; 6 first-instar nymphs and several embryos—they are conspecific with the USNM material); USNM has 3 slides containing: 1 adult female; 2 first-instar nymphs; and 5 first-instar nymphs, (Maskell Collection No. 378). A box of dry material containing several unopened galls has a label inside “*Sphaerococcus froggatti*, Mask./on *Melaleuca linariifolia*/No. 25. W. W. Froggatt, N.S.W.” and also is considered to be part of the syntype series. The Maskell Collection ledger entry is: “378. *Sphaerococcus* Froggatt., Maskell Australia/insects in galls in situ/ Maskell—N. Z. Trans. Vol. XXVI, 1893 p. 94” Notes by Morrison are as follows: “*Sphaerococcus froggatti* Mask. Box 20. The M.C. includes two slides of this species, one of ‘larvae, 1893,’ the other of ‘adult female, 1893,’ both in rather good condition. There are a considerable number of galls of this species, presumably, in 4 clusters on terminal twigs of host under #378.” There is a photograph with the label

"*Sphaerococcus froggatti* Mask./Female Galls on Twigs/Maskell Coll. No. 378" in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland. There are 2 slides in the BMNH labeled "*Sphaerococcus/froggatti*, Mask./Australia, Sydney/On *Mela. linarifolia*/Ex. coll. Froggatt/R. N. BM 1945, 121." These slides include the following: 4 adult females; 6 first-instar nymphs. These apparently are not part of the type series but were collected by Froggatt near the type locality. There also are two pill boxes of dry material from this same collection; the outside of the boxes are labeled in Maskell's handwriting "*Sphaerococcus*/sp. nov." and "*Sphaerococcus/Froggatti/Mask.*"

Type data.—Australia, Flemington, near Sydney, on *Melaleuca linariifolia*, Froggatt.

Discussion.—DRM has examined type material of this species and concludes that it belongs in the Eriococcidae for the following reasons: the first-instar nymph possesses microtubular ducts, enlarged lateral setae, and a 3-segmented labium. The adult female is very similar to the adult female of *Sphaerococcus socialis*.

Sphaerococcus graminis Maskell,
1897:244

Current placement.—Pseudococcidae—*Antonina graminis* (Maskell) (combination by Fernald 1903).

Selected references and discussion.—This species was described in detail by Yang and Kosztarab (1967), and Williams (1985), and was cataloged by Ben-Dov (1994); for additional information refer to these publications.

Sphaerococcus inflatipes Maskell,
1893:238–240

Current placement.—Eriococcidae—*Sphaerococcopsis inflatipes* (Maskell) (combination by Cockerell 1899).

Selected references.—Hoy (1963:193)(included in catalog of Eriococcidae), Beardsley (1972, 1974a)(lectotype designation

and redescription in revision of *Sphaerococcopsis*).

Type material.—Lectotype adult female in ANIC; 3 paralectotype slides and 1 pill box of dry material in NZAC, and 3 paralectotype slides in USNM containing: 2 adult females; 5 adult females; and 3 second-instar female exuviae (Maskell Collection No. 299). The Maskell Collection ledger entry is "299. *Sphaerococcus inflatipes* (type) Maskell Australia/insects in situ/N. Z. Trans. Vol. XXV, p. 238, 1892." There are no notes by Morrison but there is a photograph with the label "*Sphaerococcopsis inflatipes* (Mask.)/Female Tests on Bark/Maskell Coll. No. 299" in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland.

Type data.—Australia, Victoria, Myrning, on *Eucalyptus* sp., French.

Discussion.—Based on the description of Morrison and Morrison (1922:31) the first-instar nymph possesses conical setae typical of the Eriococcidae and has leg setae arranged similarly to other first-instar eriococcids. The adult male (with a complete dorsal-ventral penial sheath), chromosome system (with heterochromatic chromosomes), and chromosome number (with either 16 or 18 pairs of chromosomes) is typical of the eriococcids (Beardsley personal communication 1997). Examination of an adult female by DRM revealed the presence of translucent pores on the hind pair of legs on the tibia and tarsus and invaginated tubular ducts that are characteristic of some species of Eriococcidae. All of the above support the hypothesis that *S. inflatipes* is an eriococcid. However, abundant leg setae on the adult female and a 1- or possibly 2-segmented labium are atypical of the family. At one time, Beardsley suggested that *Sphaerococcopsis* and *Lachnodius* should be included in a separate family (Beardsley 1972), but he has since decided that the genera are correctly placed in the Eriococcidae (Beardsley personal communication 1997). We concur with this decision.

Sphaerococcus inflatipes var. *simplicior*
Maskell, 1896:403

Current placement.—Eriococcidae—*Sphaerococcopsis simplicior* (Maskell) (combination by Morrison and Morrison 1922).

Selected references.—Morrison and Morrison (1922:31)(considered variety to be a separate species); (Hoy 1963: 193)(treated taxon as a variety of *S. inflatipes*, catalog); Beardsley (1974a:334)(re-described species).

Type material.—Lectotype adult female is in ANIC; 1 paralectotype slide and 1 pill box of dry material in NZAC; 3 paralectotype slides in USNM containing: 1 adult female and many embryos; 3 first-instar nymphs; 1 first-instar nymph (Maskell Collection No. 455). The Maskell Collection ledger entry is "455. *Sphaerococcus inflatipes* var. *simplicior* Maskell Australia/insects in situ/Maskell-N. Z. Trans. 1895 p." There are no notes by Morrison, but there is a photograph with the label "*Sphaerococcopsis inflatipes/simplicior* (Mask.)/Female Tests on Bark/Maskell Coll. No. 455" in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland.

Discussion.—The first-instar nymphs of this species were examined by DRM and possess longitudinal lines of enlarged setae including those around the body margin, have leg setae typical of eriococcids, and have a few dorsal microtubular ducts. The adult female has translucent pores on the hind femur and tibia. All of these features support the hypothesis that *S. simplicior* should be placed in the Eriococcidae.

Sphaerococcus leaii Fuller, 1897:1346

Current placement.—Eriococcidae—*Casuarinaloma leaii* (Fuller); type species of *Casuarinaloma* (combination by Froggatt 1933).

Selected references.—Fuller (1899: 448)(detailed redescription including first-instar nymph); Froggatt (1921)(brief description of gall and adult female); Froggatt

(1933)(placed species in new genus *Casuarinaloma*); Hoy (1963)(catalog).

Type material.—Syntypes in USNM as follows: Slide 1 with left label "On Casuarina/Swan R. (banks)/W.A./ 97/Larvae leaii"; right label "*Sphaerococcus/Leaii, Fuller/Larvae/(types)/402*"; the paper envelope containing the slide states "leaii Fuller W. Australia Brain Coll./On Casuarina sp. Fuller type/Brain #402/Casuarinaloma/(*Sphaerococcus*) 39 2882"; it contains 6 uncleared first-instar nymphs. Slide 2 with left label "*Sphaer. pulchellus/leaii/402*"; right label "*Sphaerococcus/Leaii, Fuller/(types)/[On Casuarina sp./Swan R. Perth W. Aust.]*"; the paper envelope is identical with the one above; the slide contains 5 unstained adult females and many embryos.

Discussion.—The first-instar nymphs of this species have enlarged setae arranged in longitudinal lines including the body margin and have protruding anal lobes with associated enlarged setae. The adult female has enlarged setae and the hind femora apparently have translucent pores. The presence of these characters supports the hypothesis that this species belongs in the Eriococcidae. Because of the poor condition of the material examined it was not possible to ascertain the number of labial segments or the occurrence of microtubular ducts.

Sphaerococcus leptospermi Maskell,
1894a:92–94

Current placement.—Asterolecaniidae—*Callococcus leptospermi* (Maskell).

Selected references and discussion.—This species was described in detail by Coles et al. (1988); for additional information refer to this publication. Also see Morrison and Morrison (1927:13)(redescription of adult female); Koteja (1974:83)(description of labium, included in *Callococcus* group). There is a photograph with the label "*Sphaerococcus leptospermi* Mask./Female Galls on Twigs/Maskell Coll. No. 301" in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland.

Sphaerococcus leptospermi: Ferris,
1919:249

Current placement.—Lecanodiaspididae—*Gallinococcus leptospermi* (Morrison and Morrison), **new combination**; type species of *Gallinococcus*.

Selected references.—See discussion.

Type material.—The holotypes of *Amorphococcus leptospermi* Morrison and Morrison (1927) and *Gallinococcus ferrisi* Lambdin and Kosztarab (1973) are the same specimen, and labeled as follows: Left label in red "Amorphococcus/leptospermi/n.sp./Holotype/HM." in black ink "8480/Sphaerococcus/leptospermi Mask/on/Leptospermum/N. S. W./W. W. Froggatt"; in pencil "40358/B." Right label is not original and states in pencil "Leptospermi/associated with Lecanodiaspis/H. M. March 11./1952"; in ink "*Gallinococcus ferrisi* n. sp./Det. Lambdin & Krb." In addition there are 3 paratype slides with 3 complete adult females and 4 paratype slides containing fragments of adult females; all in USNM.

Discussion.—Based on material sent to him by Froggatt, Ferris (1919) described and illustrated what he thought was *S. leptospermi* (Maskell); he treated it as a new combination "*Amorphococcus leptospermi* (Maskell)." The specimens that he described were not *S. leptospermi* but were of a species previously undescribed. Based on the International Code of Zoological Nomenclature (1985) Article 49, this misidentification cannot be used as a valid description of the new taxon even though it was not included in *Sphaerococcus*. The misidentification was first discovered by Morrison and Morrison (1927:3, 14) who described the species as "*Amorphococcus leptospermi* new species." Since the name used by Ferris has no validity under the Rules of Zoological Nomenclature, the name and description presented by Morrison and Morrison are the first to validate the species. Lindinger (1943:206) incorrectly considered *A. leptospermi* Morrison

and Morrison to be a junior, primary homonym of *A. leptospermi* Ferris and proposed *Amorphococcus fallax* Lindinger as a replacement name. This name, therefore, is a junior, objective synonym of *A. leptospermi* Morrison and Morrison. Lambdin and Kosztarab (1973) restudied the species and also described it as a new species within a new genus (*Gallinococcus ferrisi*) and placed it in the family Lecanodiaspididae. The correct name of this taxon is *Gallinococcus leptospermi* (Morrison and Morrison); *G. ferrisi* Lambdin and Kosztarab is a junior, objective synonym (**new synonymy**). For the sake of clarification the following synonymy is presented:

Amorphococcus leptospermi Maskell: Ferris, 1919:249 (misidentification).

Amorphococcus leptospermi Morrison and Morrison, 1927:3, 14.

Amorphococcus fallax Lindinger, 1943:206 (invalid replacement name).

Gallinococcus ferrisi Lambdin and Kosztarab, 1973:85 (invalid replacement name).

Gallinococcus leptospermi (Morrison and Morrison) (**new combination**)

Sphaerococcus melaleucae Maskell,
1894a:94

Current placement.—Asterolecaniidae—"Sphaerocoecus" melaleucae (Maskell), **new family assignment**.

Selected references.—Fuller (1897:10)(treated species as variety of *S. acaciae*); Froggatt (1921:12)(described female and test); Deitz and Tocker (1980:20)(family status uncertain, literature citations, and list of types).

Type material.—Syntypes in NZAC include 1 slide and 2 pill boxes (DRM examined Maskell's original slide which includes 1 adult female—it is conspecific with the USNM material); USNM includes 3 slides: complete second instar or adult female; fragment of same; a slide with an unprepared test (Maskell Collection No. 377). The Maskell Collection ledger entry is "377. *Sphaerococcus melaleucae* Maskell

Australia/insects in galls in situ/Maskell-N. Z. Trans. Vol. XXVI, 1893 p. 94." Notes by Morrison are as follows: "*Sphaerococcus melaleuca* Mask. Box 20. The M.C. includes a single good slide of this species of 'adult female, 1893,' which from a superficial examination appears to have some relationship with *S. (K.) obscurata* Mask. If possible try some more tests for larvae. In the M.C. are 7 more or less mature tests of this species on twigs of the host under #377." There is a photograph with the label "*Sphaerococcus acaciae/melaleuca* Ckll./Female Tests on Twigs/Maskell Coll. No. 377" in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland.

Type data.—Australia, New South Wales, Penhurst, on *Melaleuca linariifolia*, W. W. Froggatt.

Discussion.—Examination of type material deposited in the NZAC and USNM by DRM reveals that this species possesses distinct 8-shaped pores and has a 3-segmented labium. Although most asterolecaniids have only a 1 or 2-segmented labium DRM proposes placing it in the Asterolecaniidae since the 8-shaped pores are typical of other members of this family and the labial structure seems to vary somewhat among families.

Sphaerococcus morrisoni Fuller,
1897:1346

Current placement.—Eriococcidae—"*Sphaerococcus*" *morrisoni* Fuller, **new family assignment**.

Selected references.—Fuller (1899:450)(description of gall, adult female, and first instar); Froggatt (1921:12)(description of gall).

Type material.—Syntype material in USNM includes 3 slides as follows: 10 immature specimens; 4 adult females and numerous embryos; and 5 adult females. This material was acquired as part of the Brain Collection and is labeled "*Sphaerococcus morrisoni* Fuller/Type/ [on *Melaleuca* sp./Penyarrah, W. Aust.]/Brain #407]." The USNM also has an empty gall from the

Cockerell Collection that is labeled "*Sphaerococcus morrisoni* Full./TYPE *Melaleuca*/Ckll. Coll./Australia (Fuller)." The BMNH has dry material including 2 opened galls and 2 complete galls with the following label: "ex coll./W. W. Froggatt/Fuller/*Sphaerococcus morrisoni*."

Discussion.—Based on examination of syntype specimens by DRM, this species is placed in the Eriococcidae. Characters that support this hypothesis are the presence in one morph of first-instar nymph of simple microtubular ducts, enlarged setae arranged in longitudinal lines on the dorsum, trochanter sensoria arranged transversely; in what may be a second instar male the presence of invaginated tubular ducts; in the adult female the presence of quinquelocular pores. However, there are 2 morphs of first-instar nymphs (probably female and male) and the labium is 2-segmented; these characters normally do not occur in the Eriococcidae.

Sphaerococcus morrisoni var. *elongata*
Fuller, 1899:451

Current placement.—Eriococcidae—"*Sphaerococcus*" *morrisoni* var. *elongatus* Fuller, **new family assignment**.

References.—Fuller (1897:1346)(mentions variety as "*Sphaerococcus morrisoni* var." from Western Australia: Swan River); Fuller (1899:451)(describes gall).

Type material.—We have been unable to locate specimens of this taxon. There are 2 unopened galls in the USNM that closely match the illustration of Fuller (1899, Fig. 23), but no label information is provided other than it is "*Sphaerococcus morrisoni* var. *elongata*" and is from "W. Austral." It is part of the Cockerell Collection. There is a photograph with the label "*Sphaerococcus rugosus/elongatus* Mask./Female Galls on Twigs/Maskell Coll. No. 537" in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland.

Discussion.—Since we have been unable to locate authentic type material of this species it is difficult to assign it to a family.

However, we assume that the variety is closely related to *S. morrisoni* and therefore tentatively place it in the Eriococcidae until specimens are discovered.

Sphaerococcus newmanni Froggatt,
1921:14

Current placement.—Asterolecaniidae—*Callococcus newmanni* (Froggatt), **new combination and family assignment.**

Selected references.—Froggatt (1921:14)(description of adult female, test, and first-instar nymph).

Type material.—P.J.G. has mounted 3 adult female syntypes and many first-instar nymphs (5 slides) from dry material and has remounted a syntype adult female from an original Froggatt slide. In addition, 12 dry female syntypes remain as part of 2 dry-mounts. All of this material is labeled in Froggatt's handwriting and is in ASCT. The dry-mounts have data labels: "Newman 1911/Perth WA/16" and "520" and the slide has 2 original Froggatt labels: "Sphaerococcus/newmani/n sp/W. Australia/Froggatt" and "Sphaerococcus/newmani/Froggatt." In addition, ANIC has 2 dry-mounts containing 11 adult females that are labeled in Froggatt's handwriting, but the data are inadequate and thus it is unclear whether these specimens are part of Froggatt's syntypic series.

Type data.—Australia, Western Australia, Busselton, L. J. Newman, on twigs of *Melaleuca* sp. Entry 520 in Froggatt's first accession notebook records no additional data.

Discussion.—P.J.G. has studied the above mentioned material and is convinced that this species is a member of the genus *Callococcus*. It closely matches the appearance of *C. pulchellus* (the type species of the genus) but differs slightly in the structure of the mid-dorsal sclerotized band of ducts.

Sphaerococcus obscuratus Maskell,
1896:403

Current placement.—Eriococcidae—*Kuwanina obscurata* (Maskell) (combination by Ferris 1919).

Selected references.—Ferris (1919:252) (redescription of adult female and first-instar nymph, related to *Kuwanina parva* (Maskell)); Froggatt (1921:14)(redescription of blisters and adult female); Kosztarab (1968:12)(family placement uncertain); Deitz and Tocker (1980:20)(information about types, depositories, and taxonomic history).

Type material.—Syntypes in NZAC including 5 slides and 2 pill boxes of dry material (DRM examined 3 of Maskell's original slides as follows: 1 adult female; 1 adult female; and 2 first-instar nymphs (one of which is an *Acanthococcus*)—they are conspecific with the USNM material); USNM including material of 2 species, one that appears to belong to *Acanthococcus* and one that is identical to the material re-described by Ferris (1919). Based on the original description of Maskell (1896) it is evident that this name did not pertain to an *Acanthococcus* since he indicated that it had reduced legs, occurred within the skin of the second instar, and occurred under the bark of the host. Material in the USNM includes 5 slides as follows: a dry mounted test; 2 adult females, some fragments, and some embryos; 3 first-instar nymphs; 1 adult female; and 1 first-instar nymph. There are 2 slides of the *Acanthococcus* species containing 1 adult female and 1 first-instar nymph (Maskell Collection No. 486). The Maskell Collection ledger entry is "486. *Sphaerococcus melaleucae* Maskell Australia/insects in situ/Maskell—N. Z. Trans. 1895 p." Notes by Morrison are as follows: "*Sphaerococcus obscuratus* Mask. [*Kuwana obscuratus* (M.) Ferris]. Box 20. The M.C. includes 5 slides of this species, two of 'adult female, 1895,' one of '2nd stage female, 1895,' one of 'late larva, 1895' one of 'early larvae, 1895.' Besides there is a slide of 'mite parasitic on Sph. obscuratus, 1895.' The larval slides are poor, but indicate a distinctly Eriococcine relationship, or else two things are mixed together. The 2nd ♀ is very poor, the adults rather good. Relationships not certain.

There are a number of pustules of this species on the bark of the host under #486 and 2 possibly ♂ sacs." There is a photograph with the label "Sphaerococcus obscuratus Mask./Female 'Galls' on Twigs/Maskell Coll. No. 486" in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland.

Type data.—According to Maskell (1896) Australia, New South Wales, Hornsby, near Sydney, on *Acacia longiflora* and *Eucalyptus obtusiflora*, W. W. Froggatt. According to Froggatt (1921) on *Acacia linarifolia* and *A. obtusiflora*.

Discussion.—DRM has examined material of this species and believes that it belongs in the Eriococcidae since it has conical setae in the first-instar nymph and adult female, a 3-segmented labium, and has microtubular ducts in the adult female. It does not appear to be congeneric with *Kuwanina parva* but is left in this genus until a more detailed analysis can be undertaken.

Sphaerococcus parvus Maskell, 1897:244

Current placement.—Eriococcidae—*Kuwanina parva* (Maskell); type species of *Kuwanina* (combination by Cockerell in Fernald 1903).

Selected references.—Morrison and Morrison (1922:58)(redescribed, placement uncertain); Kosztarab (1968:12)(Cryptococcidae); Hoy (1963:165)(catalog, placed in Eriococcidae); Deitz and Tocker (1980:20)(information about types, depositories, and taxonomic history).

Type material.—Syntypes in CASC including 2 boxes of dry material; NZAC has 2 syntype slides and 1 pill box of dry material (DRM examined both of Maskell's original slides as follows: 1 adult female and 3 embryos; 10 uncleared first-instar nymphs—they are conspecific with the USNM material); UCD has 1 syntype slide; USNM has 4 syntype slides containing: 1 adult female; 4 adult females; 3 first-instar nymphs; and 2 first-instar nymphs (Maskell Collection No. 560). The Maskell Collection ledger entry is "560. Sphaerococcus

Japan/insects in situ/From Koebele 1897/ on cherry" Notes by Morrison are as follows: "*Sphaerococcus parvus* Mask. [*Kuwanina* Ckll). Box 20. The M.C. includes two slides of this species, one of 'adult female, 1897' and one of 'larvae, 1897.' It was previously believed that there was no material of this species, but evidently that listed as 'Sphaerococcus' under '#560' is this species. This consists of a portion on which are several ♀s enclosed in wooly sacs."

Type data.—Japan, on cherry, Koebele.

Discussion.—This species is considered to be a member of the Eriococcidae (Hoy 1963) or the Cryptococcidae (Kosztarab 1968).

Sphaerococcus pirogallis Maskell,
1894a:95

Current placement.—Asterolecaniidae—*Eremococcus pirogallis* (Maskell); type species of *Eremococcus*.

References.—Froggatt (1907:380)(described gall and infestation around Sydney); Froggatt (1921:15) (description of gall and adult female); Ferris (1919:249)(described *Eremococcus* and redescribed *S. pirogallis*); Morrison and Morrison (1922:38)(redescription of adult female, second-instar female, and first-instar nymph); Deitz and Tocker (1980:20)((information about types, depositories, and taxonomic history).

Type material.—Syntypes included in NZAC include 6 slides and 2 pill boxes of dry material (DRM examined 2 of Maskell's original slides containing 1 adult female; 1 first-instar nymph—they are conspecific with the USNM material); USNM has 6 syntype slides containing: 4 adult females; second-instar female fragment; 1 first-instar nymph, 2 second-instar females, and 2 adult females; 1 first-instar nymph, 2 second instars, and 1 adult female; 1 adult female; dry mounted slide with 2 galls (Maskell Collection Number 364). There is a single box of material that is part of the Cockerell Collection that is marked as "type" that was received by Cockerell from

Maskell. The Maskell Collection ledger entry is "364. *Sphaerococcus pirogallis* Maskell Australia/galls, female, in situ: gall cut open: female insects dorsal/and ventral view/Maskell—N. Z. Trans. XXVI 1893 p.95" There are no notes by Morrison, but there is a photograph with the label "Sphaerococcus pirogallis Mask./Female Galls/Maskell Coll. No.364" in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland. BMNH has 1 slide containing 3 adult females that might be part of the type series; it is labeled "Australia/W. W. Froggatt./1895/Let." BMNH also has 3 lots of dry material that may be part of the type series; label data from the most complete is as follows: "*Sphaerococcus pirogallis* Mask/on *Leptospermum flavescens*/Sydney—NSW—Australia/ ex coll. W. W. Froggatt."

Type data.—Australia, New South Wales, several localities around Sydney, on *Leptospermum flavescens*, W. W. Froggatt.

Discussion.—This species is widely accepted as an asterolecaniid (Morrison and Morrison 1922; Deitz and Tocker 1980).

Sphaerococcus populi Maskell, 1898:248

This species is now placed in the Aphididae genus *Doraphis* according to Eastop and Hille Ris Lambers (1976) and was illustrated by Ferris (1936:15) who considered it to be part of *Nipponaphis*. There is a photograph with the label "Sphaerococcus populi Mask./(Aphididae [sic], n.g. near *Cerataphis*)/Maskell Coll. No.486" in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland.

Sphaerococcus pulchellus Maskell,
1897a:324

Current placement.—Asterolecaniidae—*Callococcus pulchellus* (Maskell); type species of *Callococcus* (combination by Ferris 1918).

Selected references.—Ferris (1918: 329)(described *Callococcus* and redescribed *C. pulchellus*); Froggatt (1921: 17)(redescription, illustration of test); Mor-

risson and Morrison (1922:32)(redescription of adult female and first-instar nymph); Deitz and Tocker (1980:25)(information about types, depositories, and taxonomic history).

Type material.—Syntypes in NZAC include 2 slides and 2 pill boxes of dry material (DRM examined 1 of Maskell's original slides with adult female—it is conspecific with the USNM material); USNM has 1 syntype slide containing 2 adult females and 5 first-instar nymphs (Maskell Collection Number 504) (Deitz and Tocker 1980 mention dry material in USNM but it apparently is not part of the type series). The Maskell Collection ledger entry is "504. *Sphaerococcus pulchellus* Maskell W. Australia/insects in situ/from Lea 1896." Notes by Morrison are as follows: "*Sphaerococcus pulchellus* Mask. (*Callococcus* Ferris). Box 20. The M.C. includes three slides of this species, two of 'adult female, 1896' and one of 'late 2nd stage ♀, 1896.' One supplementary slide of ♀♀, immature ♀♀ and larvae has already been prepared. The material consists of 13 more or less mature ♀ tests on 2 twigs under #504." There is a photograph with the label "Sphaerococcus pulchellus Mask./Female Tests on Twigs/Maskell Coll. No. 504" in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland.

Type data.—Australia, Western Australia, possibly from the Darling Ranges, common all over south-west Australia, in the vicinity of swampy ground, host unknown, A. M. Lea. According to Froggatt (1921) it occurs on an unknown species of *Melaleuca* and *Hypocalymma angustifolium*.

Discussion.—This species is widely accepted as an asterolecaniid (Ferris 1918; Deitz and Tocker 1980).

Sphaerococcus pustulans Green, 1905:7

Current placement.—Eriococcidae—"*Sphaerococcus*" *pustulans* Green, **new family assignment**.

Selected references.—The only descrip-

tion of this species is the original treatment by Green (1905:7).

Type material.—The BMNH has 1 adult female on a slide labeled as follows: “*Sphaerococcus/pustulans*/BM Green/from *Eucalyptus/gonicalyx*./Myrmiong [sic]. Vict. Australia/coll. J. Lidgett. No 52.” The slide contains 5 adult females. In addition there is a lot of dry material with the same information. USNM has 1 syntype slide containing an adult female and part of a second-instar nymph and a box containing a twig with several undisturbed pustules. The slide is labeled as follows: “*Sphaerococcus/pustulans* Green/On Bark of *Eucalyptus/gonicalyx*./Myrmiong [sic], Victoria, Austr./J. Lidgett, Coll. (E. E. Green)/#14642.” The correct spelling of the locality is Myrmiong.

Discussion.—Based on examination of specimens deposited in the BMNH and USNM by DJW and DRM, this species should be placed in the Eriococcidae. Characters that support this hypothesis are the presence of microtubular ducts and invaginated macro-tubular ducts on the second-instar nymph, translucent pores on the hind coxa, and quinquelocular pores on the adult female. Other characters that are consistent with this family assignment on the adult females and second-instar nymph are trochanter sensoria arranged transversely and a denticle on the claw. It has a 1- or 2-segmented labium which is unusual for an eriococcid.

Sphaerococcus rugosus Maskell,
1897a:322

Current placement.—Asterolecaniidae—*Eremococcus rugosus* (Maskell), **new combination and family assignment.**

Selected references.—Froggatt (1921:17)(description of female and gall); Deitz and Tocker (1980:20)(information about types, depositories, and taxonomic history).

Type material.—Syntypes in NZAC include 2 slides and 2 pill boxes of dry material (DRM examined 1 of Maskell’s original slides with 1 poorly cleared first-instar nymph—it is conspecific with the USNM

material); USNM has 5 syntype slides as follows: dry mounted slide with 1 gall; 27 first-instar nymphs; 11 first-instar nymphs; 14 first-instar nymphs; adult female (Maskell Collection Number 536). The Maskell Collection ledger entry is “536. *Sphaerococcus rugosus* (type) Maskell West Australia/insects in situ/from Lea 1896.” Notes by Morrison are as follows: “*Sphaerococcus rugosus* Mask. Box 20. The M.C. includes 2 slides of this species, one of ‘adult female, 1896,’ one of ‘larva, 1896.’ The female is very poor but perhaps a few things can be made out. The larva is a little better and is evidently very closely related to and probably congeneric with larva of *Eremococcus pirogallis* (Maskell). The collection also included under #536. The material consists of 8 galls on 1 twig of the host under #536.” There is a photograph with the label “*Sphaerococcus rugosus* Mask./Female Galls on Twig/Maskell Coll. No. 536” in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland.

Type data.—Australia, Western Australia, Mount Barker, on *Leptospermum* sp., A. M. Lea.

Discussion.—Based on examination of syntype slides by DRM in consultation with PJG it is believed that this species belongs in *Eremococcus* or to a closely related genus. Apparently, Morrison agreed (see note above). The first-instar nymphs of the type species of *Eremococcus*, (i.e. *E. pirogallis*) and *E. rugosus* share the following characteristics: posterior abdominal segments with curved, slightly enlarged marginal setae; dorsum with 1 or 2 pairs of large tubular ducts; dorsum with sclerotized segmental areas; antennae 3-segmented; labium 2-segmented; legs with distinctive wrinkled pattern on femur. The 8-shaped pores are more tubular in nature than in *E. pirogallis*, but the setae, anal-ring area, and very large clypeolabral shield are very similar to *E. pirogallis*. *Eremococcus rugosus* does not have the distinctive antennae mentioned by Ferris (1919) and Morrison and Morrison (1922) and has only one pair of

large tubular ducts on the dorsum of the crawler; *E. pirogallis* has two pair (Morrison and Morrison 1922).

Sphaerococcus rugosus var. *elongatus*
Maskell, 1897a:322

New placement.—Asterolecaniidae—*Eremococcus rugosus* var. *elongatus* (Maskell), **new combination and family assignment.**

Selected references.—Froggatt (1921: 17)(description of female and gall); Deitz and Tocker (1980:20)(information about types, depositories, and taxonomic history).

Type material.—Syntypes in NZAC include 2 slides and 2 pill boxes of dry material (DRM examined both of Maskell's original slides as follows: 1 adult female; 1 first-instar nymph—they are conspecific with the USNM material); USNM has 4 syntype slides as follows: dry mounted slide with 1 gall; 13 first-instar nymphs; 11 first-instar nymphs; 2 adult females and several embryos (Maskell Collection No. 537). The Maskell Collection ledger entry is "536. *Sphaerococcus rugosus* var. *elongatus* Maskell West Australia/insects in situ/ from Lea 1896." Notes by Morrison are as follows: "*Sphaerococcus rugosus* var. *elongatus* Mask. Box 20. The M.C. includes 2 slides of this species, one of 'adult female, 1896' very poor and one of 'larva, 1896,' not much better. The larva very close to that of *rugosus*. The material consists of 8 mature galls and a number of immature galls, some apparently ♂'s on the leaves of the host. under #537."

Type data.—Australia, Western Australia, possibly Albany, on undetermined tree with small leaves and clusters of small flowers, A. M. Lea.

Discussion.—Based on examination of syntype slides by DRM no obvious differences were detected between this taxon and *Eremococcus rugosus*, but a more detailed examination is required to determine if *E. rugosus rugosus* and *E. rugosus elongatus* are distinct taxa.

Sphaerococcus socialis Maskell,
1897a:325

New placement.—Eriococcidae—"Sphaerococcus" *socialis* Maskell, **new family assignment.**

Selected references.—Froggatt (1907: 380)(description of gall); Froggatt (1921: 18)(mentioned); Deitz and Tocker (1980: 21)(information about types, depositories, and taxonomic history).

Type material.—Syntypes in NZAC include 5 slides and 2 pill boxes of dry material (DRM has examined all 5 of these slides containing: 1 uncleared adult male; 1 uncleared male; 1 adult female; 1 adult female; and 1 first-instar nymph—they are conspecific with USNM material); USNM has 2 syntype slides as follows: 2 adult females; 2 adult females (Maskell Collection Number 510). The Maskell Collection ledger entry is "510. *Sphaerococcus socialis* Maskell West Australia/insects in galls in situ/ from Lea 1896/Geraldton, W. Australia." Notes by Morrison are as follows: "*Sphaerococcus socialis* Mask. Box 20. The M.C. includes five slides of this species, two of 'adult female, 1896,' one of 'larva, 1896,' one of 'adult male, 1896,' and one of 'larva, 1896.' No one of these can be considered good. The material consists of 17 more or less mature galls, on small branch of host and 1 on pin under #510." There is a photograph with the label "Sphaerococcus socialis Mask./Female Galls on Twig/Maskell Coll. No. 510" in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland.

Type data.—According to Maskell (1897a): Australia, Western Australia, Geraldton, on myrtaceous plant (either *Melaleuca* or *Calothamnus*), A. M. Lea. According to Froggatt (1921) it occurs on *Melaleuca* sp.

Discussion.—According to DRM, the adult male of this species is very similar to the male of the 2 unidentified species of *Opisthoscelis* described by Theron (1968) by having the terminal 4 or 5 abdominal

segments very elongate and attenuated. The adult females also are similar by having: the anterior end of the clypeolabral shield developed into 2 large lobe-like extensions; a 1-segmented labium; and many simple quinquelocular pores. "*Sphaerococcus*" *socialis* adult females do not have the unusually elongate legs of *Opisthoscelis* species and are not congeneric. All *Opisthoscelis* species induce galls on *Eucalyptus* unlike *S. socialis* which occurs on *Melaleuca* or *Calothamnus*. The similarities of the adult males and females of *S. socialis* and *Opisthoscelis* species suggest a strong possibility of a close relationship.

Sphaerococcus stypheliae Maskell,
1895:67

Current placement.—Pseudococcidae—*Peridiococcus stypheliae* (Maskell); type species of *Peridiococcus*.

Selected references and discussion.—This species was described in detail by Williams (1985); for additional information refer to that publication.

Sphaerococcus sylvestris Cockerell and
King, 1898:326

Current placement.—Kermesidae—*Kermes sylvestris* (Cockerell and King).

Selected references and discussion.—This species was described in detail by Bullington and Kosziarab (1985); for additional information refer to that publication. There is a photograph with the label "Sphaerococcus stypheliae Mask./Female Tests on Twigs/Maskell Coll. No. 407" in the U.S. Department of Agriculture Coccoidea library at Beltsville, Maryland.

Sphaerococcus tepperi Fuller, 1897:1346

New placement.—Eriococcidae—"Sphaerococcus" *tepperi* (Fuller), **new family assignment**.

Selected references.—Fuller (1899:449)(description of gall and adult female); Froggatt (1921:18)(description of gall and female).

Type material.—The only type material

known to the authors is a single slide in the USNM that is part of the Brain Collection and has left label "on/Melaleuca/Swan R. W.A./1897"; right label "Sphaerococcus/tepperi/elegans/Fuller/(typus)/ 403." The slide contains 7 adult females, 1 or 2 embryos, and 1 shed skin. Because the original description closely matches the specimens on this slide, e.g. front two pairs of legs absent and hind pair atrophied, and because the cursory specimen data given by Fuller (1897, 1899) agree with the data on this slide, we believe that this slide is a syntype. In addition, there are two boxes of dry material in the USNM that were acquired as part of the Cockerell Collection, but they have no associated collection data other than a label that says "type" and gives the name "Sphaerococcus tepperi Fuller MS." The galls in the boxes are identical in appearance to the illustration given by Fuller (1899, figure 16).

Discussion.—Based on examination of the USNM syntypes, DRM believes that this species should be placed in the Eriococcidae. Evidence supporting this hypothesis is the presence of translucent pores on the hind legs and conical setae in the anal area. Unfortunately, the species does not have pores or ducts in the adult female and the only available embryo is in such poor condition that no diagnostic family characters can be seen. *Sphaerococcus tepperi* is superficially similar to species in the genera *Opisthoscelis* and *Capulinia* by having the legs limited to the hind pair only. In *Opisthoscelis* these legs are unusually large, but in *Capulinia* they vary from small to large and are represented by small nubs in *C. sallei* Signoret.

Sphaerococcus (Pseudolecanium) tokionis
Cockerell, 1896:49–50

Current placement.—Acleridae—*Aclerda tokionis* (Cockerell).

Selected references and discussion.—This species was described in detail by McConnell (1953); for additional information refer to that publication.

Sphaerococcus tormentosus Fuller,
1899:450

Current placement.—Eriococcidae—*"Sphaerococcus" tormentosus* Fuller.

Selected references.—Afifi and Kosztarab (1967:29)(redescription of adult male, Eriococcidae); Coles et al. (1988:23)(male described as *S. tomentosus* Fuller ? by Afifi and Kosztarab (1967) is *Callococcus leptospermi*).

Type material.—Syntypes in BMNH include a slide labeled "Sphaerococcus/tomentosus/Full./on Melaleuca sp./W. Australia/ex. coll. C. Fuller/Euparol." This slide contains 1 adult female. In addition there is an envelope containing dry material from this same collection. Syntypes in the USNM include 1 slide from the Brain Collection with left label "*Sphaerococcus/tomentosus* Fuller/Type/[On *Melaleuca* sp./Swan R. W. Australia/Brain #405]"; the slide contains 1 adult male and 6 first-instar nymphs all poorly cleared. Because the original description closely matches the specimens on this slide, e.g. first-instar nymphs with transverse rows of conical setae, and because it is labeled as type, we believe that the specimens on this slide are syntypes. The BMNH also has 2 slides labeled "Sphaerococcus/tomentosus/Full./from Leptospermum/ Australia/(Canberra, N.S.W.)/coll. Froggatt 1632." These slides apparently are not part of the type series and contain the following: 1 adult male; 4 adult females.

Discussion.—Based on examination of first-instar nymphs and the adult male, DRM believes that this species is a member of the Eriococcidae. Afifi and Kosztarab (1967) included descriptions of two different males. The one that they considered to be "*Sphaerococcus tomentosus* Fuller?" is apparently *Callococcus leptospermi* (Coles et al. 1988), the other is believed to be the adult male of *S. tormentosus* and possesses many eriococcid characteristics (Afifi and Kosztarab 1967). Examination of the first-instar nymphs reveals that they possess the

following eriococcid characteristics: Longitudinal lines of conical setae, 3-segmented labium, and protruding anal lobes. This species has often been misspelled the species epithet as *tomentosus*.

Sphaerococcus turbinata Froggatt,
1921:19

New placement.—Asterolecaniidae—*Eremococcus turbinatus* (Froggatt), **new combination and family assignment.**

Selected references.—The only descriptive treatment of this species is by Froggatt (1921:19) and he only treated the galls; the female was so badly damaged by parasites that he did not provide a description.

Type materia.—PJJ has determined that ANIC has syntypic material of this species consisting of a number of loose galls (not attached to stems and in a unit tray) plus 2 dry-mounts each with 4 mature galls attached to a piece of stem. The galls in the unit tray are accompanied by the label: "Sphaerococcus/turbinata/1518 n.sp. Frgg/Lea Launceston Tas," whereas the 2 dry-mounts are labeled: "Launceston/(A.M. Lea)/1518." Entry 1518 in Froggatt's second accession notebook is: "Sphaerococcus turbinata Fr., p. 19 Cat pIII, A.M. Lea, Melaleuca sp. Tasmania." These data exactly match those given in Froggatt (1921), even to the extent that the damage to the gall matches that discussed in the original description. PJJ mounted the remains of 1 adult female in a dry gall from the unit tray in the above collection in 1997.

Discussion.—According to PJJ, this species is definitely a member of *Eremococcus* because the remains of the syntype female share the following features with *E. pirogallis* (the type species of the genus): central area of dorsum nodulose and more heavily sclerotized than rest of derm, anal ring small and simple, legs absent, clypeolabral shield large and sclerotized, and 8-shaped pores abundant marginally. Gullan also suggests that the type host of this species may be incorrectly identified as *Melaleuca* and probably is a species of *Leptos-*

permum, based on examination of the foliage associated with the syntype galls and also her recent host records for this species.

ACKNOWLEDGMENTS

We are grateful to the following individuals for reading and commenting on the manuscript: Ms. Rosa Henderson, Landcare Research, Auckland, New Zealand; Dr. Yair Ben-Dov, The Volcani Center, Department of Entomology, Bet Dagan, Israel; and Drs. Michael E. Schauff and Steve W. Lingafelter, Systematic Entomology Laboratory, USDA (SEL). We are especially grateful to Rosa Henderson for loaning us critical specimens from the Maskell Collection in NZAC so that DRM could be certain that the material in the USNM is conspecific. We also thank Dr. F. Christian Thompson (SEL) for his advice concerning the status of *Gallinococcus leptospermi*.

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